Boeing Aerospace Operations

ORBITAL TRANSFER VEHICLE Launch Operations Study

(NASA-CR-179705) ORBITAL TRANSFER VEHICLE LAUNCH OPERATIONS STUDY: MANPOWER SUMMARY AND FACILITY REQUIREMENTS, VOLUME 5 Final Report (Boeing Aerospace Co.) 36 p CSCL 22D

N86-32504

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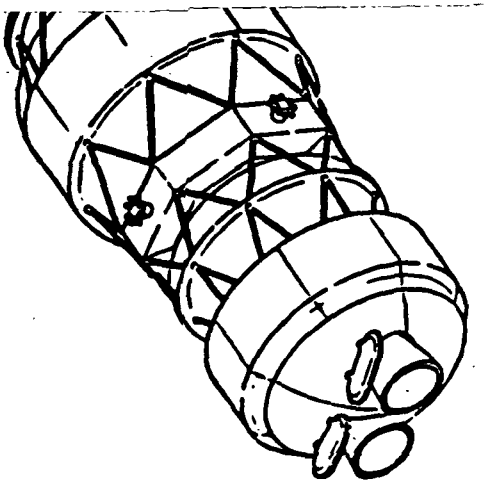

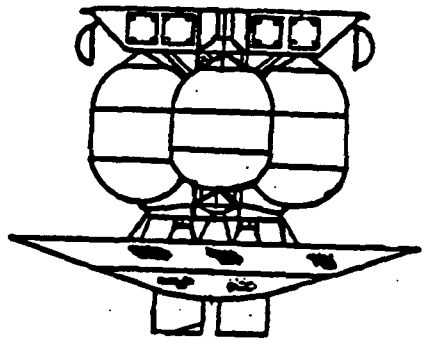

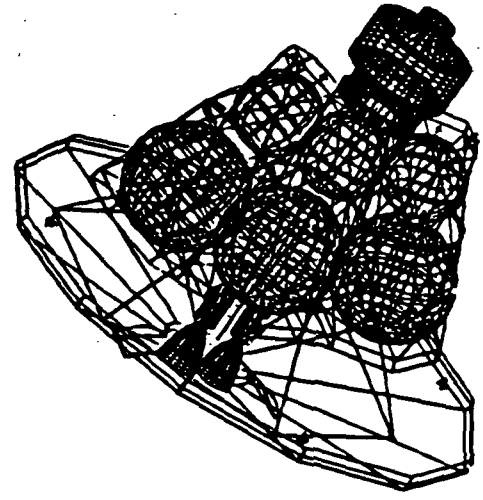

MANPOWER SUMMARY & FACILITY REQUIREMENTS

VOLUME 5 OF 5

MARCH 7, 1986

FINAL REPORT

KENNEDY SPACE CENTER
NAS10-11165

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MANPOWER

All manpower numbers: number of heads (by skill), serial time and manhours have been accumulated and compiled on a per subtask basis in spreadsheet format for both the Ground Based and the Space Based flows. These basic data are included as Appendices A and B respectively in this volume so that anyone can run whatever analyses may be of interest or that apply to his/her particular interest or concern.

FACILITY IDENTIFICATION

To aid in identifying the facility resources required to process the GBOTV and/or the SBOTV through the ground facilities at KSC, a software application package was developed using a general purpose Data Base Management System known as Data Flex. The facility requirements, identified on the second page of the Ground Based RIS, are used as the basic input to this software application. The resources of the KSC facilities that could be used by the OTV Program were digitized in the same RIS format used to identify facility requirements. The "facility capabilities" were digitized in this format for subsequent, automated comparative analyses.

The software will accummulate a composite set of facility requirements from any sequential numbered group of the RIS's. The Tasks were grouped into two main task groups, Task Numbers 1 to 13 and Tasks 34 to 39. Composite facility requirement(s) were accummulated for each Task Group.

Composite facility requirements are then compared to each of the Baseline Facility capabilities and the system generates a relative score that indicates how each facility weighs against the composite requirements in relation to the other

facilities in the set. There is no perfect score but a high score is better than a low score. Each requirement can be individually weighted such that a higher priority can be given to selected requirements (such as physical size, crane capacity, or other selection) while maintaining a lower priority for other items like E.C.S, Humidity, or Potable Water. If some items are more critical, expensive, difficult, or whatever; a sort of games-manship can be played by using different weighting factors for the various items, depending upon their relative importance.

Once the system has identified the facility with the Best Fit, those modifications required to make the "Best Fit" facility match the composite requirements are generated. The Modifications report identifies the additions that must be made to the Best Fit Facility. In numeric fields like "Airlock", "High Bay", etc., the number(s) indicated in the report are those deltas in a particular field, in that facility, to bring the field up to the "composite" requirement where the number appears. In non-numeric fields like "Paging", "Vacuums", and "Shop Air", etc., an "N" indicates NO modification is required while a "Y" indicates a modification IS required. No indication is currently provided as to how much, if any, a facility exceeds any of the composite facility requrements.

APPENDIX A

GROUND BASED
ORBITAL TRANSFER VEHICLE
SPREAD SHEET
MANPOWER AND TIME SUMMARIES

	1	2	3	4	5	6	7	8	9	10	11	12
1		GROUND BASED OTV MANPOWER										
2	TASK	TITLE			SKILLS				TIME			
3	NO.							SERIAL	TOTAL	TOTAL	MAN	TOTAL
4								TIME	SERIAL	SERIAL	HOURS	MH
5			P/L	ENG.	TECH.	QUAL	OTH	(MIN)	TIME	TIME		
6			SPEC						(MIN)	(HRS)		
7												
8	1	OTV RECEIVING & INSPECTION										
9	1.01	TRANSPORTATION LAND	0	0	2	1	0	5760				
10	1.02	TRANSPORTATION BARGE	0	0	2	1	0	5760			288	
11	1.03	TRANSPORTATION AIR	0	0	1	1	0	480				
12	1.04	TRANSFER TO RECEIVING	0	2	4	2	0	480			64	
13	1.05	RECEIVING	0	1	2	1		480			32	
14	1.06	TRNSFR OTV TO OTVPF AIRLK	0	2	5	1	0	240			32	
15	1.07	TRNSFR OTV TO CLEAN ROOM	0	1	5	2	0	480			64	
16	1.08	OTV INSPECTION	0	2	3	1	0	480			48	
17	1	TOTAL							7920	132		528
18	2	OTV MECHANICAL ASSEMBLY										
19	2.01	INSTALL ASSEMBLY STRUCT	0	2	5	2	0	960			144	
20	2.02	INSTALL CRYO TANK SET	0	2	5	2	0	720			108	
21	2.03	INSTALL RCS TANK SET	0	2	5	2	0	360			54	
22	2.04	INSTL PROPL SYS & CNTRL	0	2	5	2	0	480			72	
23	2.05	INSTALL RCS/ENGINES	0	2	5	2	0	480			72	
24	2.06	INSTALL RCS NOZZLE COVERS	0	1	3	1	0	60			5	
25	2.07	MATE MECH CONNNECTIONS	0	1	3	1	0	300			25	
26	2	TOTAL							3360	56		480
27	3	ELECTRICAL ASSEMBLY										
28	3.01	INSTALL CABLE HARNESS	0	1	3	1	0	360			30	
29	3.02	INSTALL POWER SYSTEM	0	1	3	1	0	480			40	
30	3.03	INSTALL GN&C SYSTEM	0	1	3	1	0	240			20	
31	3.04	INSTALL AVIONICS SYSTEM	0	1	3	1	0	240			20	
32	3.05	MAKE ALL ELEC CONNECTORS	0	1	3	1	0	300			25	
33	3	TOTAL							1620	27		135
34	4	MECHANICAL SYSTEM TESTS										
35	4.01	LEAK & PRESSURE CHECKS	0	2	2	2	0	1380			138	
36	4	TOTAL							1380	23		138
37	5	ELECTRICAL SYSTEMS TEST										
38	5.01	GROUND POWER APPLICATION	0	1	2	1	0	240			16	
39	5.02	SINGLE POINT GROUND CHECK	0	1	2	1	0	180			12	
40	5.03	ACTIVATE POWR/ESSENTL BU	0	3	4	3	0	60			10	
41	5.04	AVIONICS POWER ON CHECKS	0	3	4	3	0	180			30	
42	5.05	DPA SUBSYSTEM CHECKS	0	3	4	3	0	30			5	
43	5	TOTAL							690	11.5		73
44	6	INTEGRATED SYSTEMS TEST										
45	6.01	AEROBRAKE CONTROL CHECKS	0	4	8	4	0	480			128	
46	6.02	EXTENDABLE EXIT CONE CHEC	0	4	4	3	0	240			44	
47	6.03	ENGINE GIMBLE CHECKS	0	4	4	3	0	120			22	
48	6.04	INTEGRATED SYSTEMS CHECK	0	4	4	3	0	1438			264	
49	6.05	GPS OPERATION CHECKS	0	4	4	3	0	720			132	
50	6	TOTAL							2998	50		590
51	7	OTV/CS-G TEST										
52	7.01	OTVCS RF TEST	0	4	4	3	0	960			176	
53	7	TOTAL							960	16		176

	1	2	3	4	5	6	7	8	9	10	11	12
54												
55		GROUND BASED OTV MANPOWER										
56		PAGE 2										
57												
58	8	MOVE OTV TO CRYO LOAD FAC										
59	8.01	PREP TRNSPORT TO CRYO FAC	0	1	5	2	0	240			32	
60	8.02	REMOVE OTV FROM WORKSTAI	0	1	5	2	0	540			72	
61	8.03	MOVE OTV TO CRYO FACILITY	0	1	2	1	0	240			16	
62	8	TOTAL							1020	17		120
63	9	OTV CRYO LOAD & DRAIN										
64	9.01	INSTL OTV INTO CRYO LOAD F	0	1	5	2	0	240			32	
65	9.02	CONNECT CRYO LINES TO VEHI	0	1	5	2	0	240			32	
66	9.03	LOAD CRYO IN OTV	0	2	2	2	0	240			24	
67	9.04	VERIFY CRYO LOAD PARA	0	2	2	2	0	60			6	
68	9.05	LOAD FUEL CELLS	0	2	2	2	0	240			24	
69	9.06	DRAIN CRYO AND PURGE	0	2	2	2	0	240			24	
70	9.07	FUEL CELL POWER TEST	0	2	2	2	0	240			24	
71	9.08	DISCONNECT CRYO LINES	0	1	5	2	0	60			8	
72	9	TOTAL							1560	26		174
73	10	MOVE OTV TO SC INTEG FACIL										
74	10.01	REMOVE OTV FROM CRYO STNI	0	1	5	2	0	120			16	
75	10.02	INSTALL OTV INTO TRNSPORT	0	1	5	2	0	180			24	
76	10.03	MOVE TRNSPORT TO INT FAC	0	1	3	1	0	120			10	
77	10.04	MOVE TRNSPORTR INTO AIRLC	0	1	5	2	0	120			16	
78	10.05	INSTALL OTV INTO WORKSTAI	0	1	5	2	0	240			32	
79	10	TOTAL							780	13		98
80	11	OTV/SC MECH/ELEC MATE										
81	11.01	MECH MATE OTV TO S/C	0	1	6	2	0	480			72	
82	11.02	ELECT MATE OTV TO S/C	0	1	2	1	0	240			16	
83	11	TOTAL							720	12		88
84	12	OTV/SC INTEG TEST										
85	12.01	OTV S/C SINGLE POINT GND	0	1	2	1	0	60			4	
86	12.02	CONNECT OTV TO GPU	0	1	2	1	0	120			8	
87	12.03	CONNECT S/C TO GPU	0	1	2	1	0	120			8	
88	12.04	CONNECT INSTRU CELS	0	3	6	4	0	120			26	
89	12.05	CMD/DATA RF CHECKS	0	3	4	3	0	300			50	
90	12.06	OTV S/C INTERFACE TEST	0	3	4	3	0	120			20	
91	12	TOTAL							840	14		116
92	13	OTV/SC/CITE INTERFACE TEST										
93	13.1	DATA PATH VERIFICATION	0	3	4	3	0	480			80	
94	13.2	FUNCTIONAL VERIF. OF RF	0	3	4	3	0	1200			200	
95	13	TOTAL							1680	28		280
96	14	CLOSEOUT & PREP TO MOVE										
97	14.01	PREP TO MOVE	0	1	5	2	0	720			96	
98	14	TOTAL							720	12		96
99	15	INSTALL IN CANISTER										
100	15.01	INST OTV S/C IN CANISTER	0	1	5	2	0	240			32	
101	15.02	TRANSPORT CANISTER TO PA	0	1	3	1	0	240			20	
102	15	TOTAL							480	8		52
103	16	INSTALL IN RSS PGHM										
104	16.01	MATE CANISTER TO PCR	0	1	5	2	0	360			48	
105	16.02	REMOVE OTV S/C FRM CANIS	0	1	5	2	0	240			32	
106	16	TOTAL							600	10		80

	1	2	3	4	5	6	7	8	9	10	11	12
107		GROUND BASED OTV MANPOWER										
108		PAGE 3										
109	17	ADDN'L SUBSYS INSTALLATION										
110	17.01	CONNECT BATT/ORD TEST SE	0	1	4	2	0	60			7	
111	17.02	INSTALL BATTERIES	0	1	4	2	0	180			21	
112	17.03	INSTALL ORDNANCE	0	1	4	2	0	360			42	
113	17.04	DISCON BATT/ORD TEST SET	0	1	4	2	0	120			14	
114	17.05	PERFORM PWR TRNSFR CHECK	0	3	4	3	0	120			20	
115	17	TOTAL							840	14		104
116	18	LOAD OTV RCS										
117	18.01	CONNECT RCS CART	0	1	2	1	0	120			8	
118	18.02	FILL RCS TANKS	0	1	2	1	0	120			8	
119	18.03	DISCONNECT CART	0	1	2	1	0	120			8	
120	18.04	PREP FOR ORB INSTALLATION	0	1	4	2	0	480			56	
121	18	TOTAL							840	14		80
122	19	INSTALL PAYLOAD IN ORBITER										
123	19.01	INSTALL PAYLOAD IN ORBITER	0	1	5	2	0	240			32	
124	19.02	MATE ELEC/MECH SVC LINES	0	1	4	2	0	180			21	
125	19	TOTAL							420	7		53
126	20	P/L TO ORB I/F VERIFICATION										
127	20.01	POWER UP ORBITER	1	0	0	0	0	60			1	
128	20.02	POWER UP PAYLOAD	0	3	4	3		180			30	
129	20.03	PERFORM CMD TEST VIA MCD	0	3	4	3	0	240			40	
130	20.04	OTV/SC HEALTH CHECKS	0	3	4	3	0	120			20	
131	20	TOTAL							600	10		91
132	21	SPACECRAFT POCC TEST										
133	21.01	ISSUE S/C CMDS FROM POCC	0	3	4	3	0	240			40	
134	21.02	VERIFY SPACECRAFT RESP	0	3	4	3	0	120			20	
135	21.03	POWER DOWN SPACECRAFT	0	3	4	3	0	60			10	
136	21	TOTAL							420	7		70
137	22	FINAL PAYLOAD CLOSEOUT										
138	22.01	REMOVE BEFORE FLIGHT ITEMS	0	1	2	1	0	240			16	
139	22.02	APPLY POWER TO SC	0	0	0	0	0	240			0	
140	22.03	CMD S/C TO PRE-LAUN MODE	0	0	0	0	0	30			0	
141	22.04	REMOVE POWER FROM SC	0	0	0	0	0	60			0	
142	22.05	ENGR INSP/FINAL CLOSEOUT	0	2	2	1	0	60			5	
143	22	TOTAL							630	10.5		21
144	23	LAUNCH PREPS										
145	23.01	APPLY POWER TO OTV	0	3	4	3	0	120			20	
146	23.02	LOAD/MONITOR CRYO	0	2	2	2	0	120			12	
147	23.03	ACTIV/LOAD TEST FUEL CELL	0	2	2	2	0	120			12	
148	23.04	LAUNCH	0	2	2	2	0	180			18	
149	23	TOTAL							540	9		62
150	24	DEPLOY OTV/SPACECRAFT										
151	24.01	OPEN CARGO BAY DOORS	1	0	0	0	0	60			1	
152	24.02	POWER UP SPACECRAFT	1	0	2	2	2	60			7	
153	24.03	PAYLOAD VERIFICATION TEST	1	2	2	2	0	240			28	
154	24.04	REMOVE P/L FROM CARGO BA	2	2	2	2	0	120			16	
155	24.05	ELEC,MECH FLUID DISCONNECT	1	2	2	2	0	60			7	
156	24.06	INSTALL/DEPLOY AEROBRAKE	3	0	0	0	0	120			6	
157	24.07	PERFORM POCC LAUNCH TEST	1	2	2	2	0	60			7	
158	24.08	DEPLOY OTV S/C FRM ORBITER	1	2	2	2	0	60			7	
159	24	TOTAL							780	13		79

	1	2	3	4	5	6	7	8	9	10	11	12
160												
161		GROUND BASED OTV MANPOWER										
162		PAGE 4										
163												
164												
165	25	LAUNCH FROM LEO										
166	25.01	VERIFY NAV POSITION	0	2	2	2	0	60			6	
167	25.02	VERIFY PROPULSION SYSTEM	0	2	2	2	0	60			6	
168	25.03	LAUNCH TO GEO	0	2	2	2	0	240			24	
169	25	TOTAL							360	6		36
170	26	PERFORM MISSION										
171	26.01	DEPLOY SPACECRAFT	0	2	2	2	0	60			6	
172	26	TOTAL							60	1		6
173	27	ORIENT AND RET - GEO TO LEO										
174	27.01	ISSUE NAV UPDATE	0	2	2	2	0	60			6	
175	27.02	POSITION OTV TO DE-ORBIT	0	2	2	2	0	60			6	
176	27.03	FIRE ENGINES	0	2	2	2	0	60			6	
177	27.04	ORBIT IN LEO	0	2	2	2	0	240			24	
178	27	TOTAL							420	7		42
179	28	ORBITER AND OTV RENDEZVOUS										
180	28.01	POS'N OTV IN STANDOFF ORBI	0	2	2	2	0	240			24	
181	28	TOTAL							240	4		24
182	29	OTV RECOVERY										
183	29.01	RETRACT EEC,VERIFY OTV SAI	0	2	2	2	0	120			12	
184	29.02	VENT OTV CRYO SYSTEM	2	0	0	0	0	240			8	
185	29.03	OTV CAPTURE	2	0	0	0	0	60			2	
186	29.04	REM AND STO AEROBRAKE	3	0	0	0	0	180			9	
187	29.05	LOAD OTV IN ORBITER BAY	3	0	0	0	0	120			6	
188	29.06	PREPARE OTV FOR DE-ORBIT	2	0	0	0	0	180			6	
189	29	TOTAL							900	15		43
190	30	RETURN TO LAUNCH SITE										
191	30.01	DE-ORBIT	0	0	0	0	0	0				
192	30.02	LAND AT KSC	0	0	0	0	0	0				
193	30	TOTAL							0	0		0
194	31	REMOVE OTV FROM ORBITER										
195	31.01	MOVE ORBITER TO OPF	0	0	0	0	0	120			0	
196	31.02	REMOVE OTV	0	2	4	2	0	180			24	
197	31.03	INST OTV IN TRANSPORTER	0	1	5	2	0	120			16	
198	31	TOTAL							420	7		40
199	32											
200	32.01											
201	32								0	0		0
202	33											
203	33.01											
204	33								0	0		0
205	34	MOVE TO PROCESS FACIL										
206	34.01	MOVE OTV TO OTVPF	0	1	3	1	0	120			10	
207	34.02	REM OTV FRM TRANSPORTER	0	1	5	2	0	300			40	
208	34.03	INSTALL OTV IN WORKSTAND	0	1	5	2	0	240			32	
209	34.04	REMOVE BAT/ORD	0	1	4	1	0	180			18	
210	34.05	PURGE AND LEAK CHECK CRYO	0	1	2	1	0	180			12	
211	34.06	INSTALL OTV GPU/GSE	0	1	2	1	0	120			8	
212	34	TOTAL							1140	19		120

	1	2	3	4	5	6	7	8	9	10	11	12
213		GROUND BASED OTV MANPOWER										
214		PAGE 5										
215	35	CONDUCT PLANNED MAINT										
216	35.01	REFURB AEROBRAKE SYSTEM	0	2	6	2	0	600			100	
217	35.02	REM ENG PUMPS FOR REFURB	0	2	6	2	0	360			60	
218	35.03	REINSTALL ENGINE/PUMPS	0	2	6	2	0	360			60	
219	35.04	REINSTALL AEROBRAKE ASSY	0	2	6	2	0	240			40	
220	35	TOTAL							1560	26		260
221	36	CONDUCT UNPLANNED MAINT										
222	36.01	CONDUCT UNPLANNED MAINT	0	0	0	0	0	0				
223	36	TOTAL							0	0		0
224	37	INSTALL MODIFICATIONS										
225	37.01	INSTALL MODIFICATIONS	0	0	0	0	0	0				
226	37	TOTAL							0	0		0
227	38	RETEST VERIFICATION										
228	38.01	APPLY POWER TO OTV	0	3	4	3	0	60			10	
229	38.02	PERFM OTV HEALTH CHECKS	0	3	4	3	0	60			10	
230	38.03	REMOVE POWER FROM OTV	0	3	4	3	0	60			10	
231	38	TOTAL							180	3		30
232	39	OTV STOR & RTN TO FLOW										
233	39.01	COVER OTV	0	1	4	2	0	60			7	
234	39.02	SEAL OTV	0	1	6	2	0	60			9	
235	39.03	REMOVE SEAL	0	1	4	1	0	60			6	
236	39.04	REMOVE COVERS ON OTV	0	1	4	1	0	60			6	
237	39.05	RETURN OTV TO FLOW	0	1	2	1	0	180			12	
238	39	TOTAL							420	7		40
239												
240		GRAND TOTALS FOR GROUND										
241		BASED OTV PROCESSING										
242												
243		TOTAL SERIAL TIME (MIN)							38098			
244												
245												
246		TOTAL SERIAL TIME (HRS)								635		
247		TOTAL MANHOURS (HRS)										4425
248												
249												
250												
251												
252												
253												
254												
255												

APPENDIX B

SPACE BASED
ORBITAL TRANSFER VEHICLE
SPREAD SHEET
MANPOWER AND TIME SUMMARIES

	1	2	3	4	5	6	7	8	9	10	11
1	SPACE	BASED OTV MANPOWER									
2		REQUIREMENTS				SERIAL	TOTAL	TOTAL		TOTAL	HOURS
3			STA.	STA.	CS-G	TIME	SERIAL	SERIAL	IVA	EVA	GND
4	TASK	TASK TITLE	SPEC	SPEC		(MIN)	TIME	TIME			
5	NO.		IVA	EVA			(MIN)	(HRS)			
6											
7	1	RECEIVING & INSPECTION									
8	1.04	TRANSFER TO STATION	1	2		240		4	4	8	
9	1.055	RECEIVING	3			300		5	15	0	
10	1	TOTAL					540	9	19	8	
11	2	OTV MECH ASSEMBLY									
12	2.01	INSTALL ASSY STRUCTURE	2			960		16	32		
13	2.02	INSTALL CRYO TANK SET	2			300		5	10		
14	2.03	INSTALL RCS TANK SET	2			360		6	12		
15	2.04	INSTL PROPL SYS/CTRL	2			480		8	16		
16	2.05	INSTALL RCS/ENGINES	2			480		8	16		
17	2	TOTAL					2580	43	86		
18	3	ELECTRICAL ASSEMBLY									
19	3.02	INSTALL POWER SYSTEM	2			480		8	16		
20	3.03	INSTALL GN&C SYSTEM	2			240		4	8		
21	3.04	INSTALL AVIONICS SYSTEM	2			240		4	8		
22	3	TOTAL					960	16	32		
23	4	MECHANICAL SYSTEM TEST									
24	4.01	LEAK & PRESSURE CHECKS	2			1380		23	46		
25	4	TOTAL					1380	23	46		
26	5	ELECTRICAL SYSTEM TEST									
27	5.015	SS POWER ACTIVATION	2			240		4	8		
28	5.02	SINGLE POINT GND CKS	2			180		3	6		
29	5.03	ACTIVATE PWR/ESS. BUS	2			60		1	2		
30	5.04	AVIONICS POWER ON CKS	2			180		3	6		
31	5.05	DPA SUBSYS CHECKOUT	2			30		1	1		
32	5	TOTAL					690	12	23		
33	6	INTEGRATED SYSTEM TEST									
34	6.01	AEROBRAKE CONTROL CKS	2		6	240		4	8		24
35	6.02	EXTNDBLE ENGINE CONE CKS	2		6	60		1	2		6
36	6.03	ENGINE GIMBLE CHECKS	2		6	120		2	4		12
37	6.04	INTEGRATED SYS CHECKS	2		6	1440		24	48		144
38	6.05	GPS OPERATION CHECKS	2		6	120		2	4		12
39	6	TOTAL					1980	33	66		198
40	7	OTV/CS-G TEST									
41	7.01	OTVCS RF TEST	2		6	960		16	32		96
42	7	TOTAL					960	16	32		96
43	11	OTV SPACECRAFT MATE									
44	11.01	MECH MATE OTV TO SC	1	2	6	360		6	6	12	36
45	11.02	ELEC MATE OTV TO SC	1	2	6	240		4	4	8	24
46	11	TOTAL					600	10	10	20	60
47	12	OTV SC INTEGRATION									
48	12.05	CMD/DATA RF CHECKS	2		6	300		5	10		30
49	12.06	OTV SC INTERFACE TEST	2		6	120		2	4		12
50	0	TOTAL					420	7	14		42
51											
52											
53											

	1	2	3	4	5	6	7	8	9	10	11
54	SPACE	BASED OTV MANPOWER									
55		REQUIREMENTS									
56		PAGE 2									
57	17	INSTALL BATT & ORD	2		6	180		3	6		18
58	17.02	INSTALL BATTERIES	2		6	360		6	12		36
59	17.03	INSTALL ORDNANCE	2		6	120		2	4		12
60	17.05	PERFORM PWR XFER CKS					660	11	22		66
61	17	TOTAL									
62	18	LOAD OTV RCS	2		6	120		2	4		12
63	18.02	FILL RCS TANKS					120	2	4		12
64	18	TOTAL									
65	21	SPACECRAFT POCC TEST	2		6	240		4	8		24
66	21.01	ISSUE SC CMDS - POCC	2		6	120		2	4		12
67	21.02	VERIFY SC RESPONSE	2		6	60		1	2		6
68	21.03	POWER DN SPACECRAFT					420	7	14		42
69	21	TOTAL									
70	22	CLOSEOUT/ PREPS TO MOVE	2		6	720		12	24		72
71	22.015	DISCONNECT UMBILICALS	2		6	240		4	8		24
72	22.025	MOVE FROM HANGAR	2		6	120		2	4		12
73	22.035	INSTALL/DEPLOY BRAKE	2		6	240		4	8		24
74	22.045	INSTALL OMV ON THE OTV	2		6	240		4	8		24
75	22.055	PL/OMV TO LAUNCH SITE					1560	26	52		156
76	22	TOTAL									
77	23	OTV/SC LAUNCH PREPS	2		6	60		1	2		6
78	23.01	APPLY POWER TO OTV	2		6	480		8	16		48
79	23.02	LOAD/MONITOR CRYO	2		6	120		2	4		12
80	23.03	ACTIV/LOAD FUEL CELLS	2		6	240		4	8		24
81	23.045	APPLY PWR TO SC	2		6	30		1	1		3
82	23.055	SC TO PRELAUN MODE					930	16	31		93
83	23	TOTAL									
84	24	DEPLOY OTV/SC	2		6	60		1	2		6
85	24.07	PERFM POCC TESTS	2		6	300		5	10		30
86	24.085	REL OTV/SC FRM OMV					360	6	12		36
87	24	TOTAL									
88	25	LAUNCH FROM LEO	2		6	60		1	2		6
89	25.01	VERIFY NAV POSITION	2		6	60		1	2		6
90	25.02	VERIFY PROPUL SYSTEM	2		6	240		4	8		24
91	25.03	LAUNCH TO GEO					360	6	12		36
92	25	TOTAL									
93	26	PERFORM MISSION	2		6	60		1	2		6
94	26.01	DEPLOY SPACECRAFT					60	1	2		6
95	26	TOTAL									
96	27	ORIENT/RTN - GEO TO LEO	2		6	60		1	2		6
97	27.01	ISSUE NAV UPDATE	2		6	60		1	2		6
98	27.02	ORIENT OTV TO DE-ORBIT	2		6	60		1	2		6
99	27.03	FIRE ENGINES	2		6	240		4	8		24
100	27.04	ORBIT IN LEO					420	7	14		42
101	27	TOTAL									
102	28	S.S./ OTV RENDEZVOUS	2		6	240		4	8		24
103	28.01	POS OTV-STANDOFF ORBIT					240	4	8		24
104	28	TOTAL									
105											
106											

	1	2	3	4	5	6	7	8	9	10	11
107	SPACE	BASED OTV MANPOWER									
108		REQUIREMENTS									
109		PAGE 3									
110	29	OTV RECOVERY	2		6	120		2	4		12
111	29.01	RETRCT EEC, VERIF SAFE	2		6	240		4	8		24
112	29.02	VENT OTV CRYO SYSTEM	2		6	60		1	2		6
113	29.03	OTV CAPTURE					420	7	14		42
114	29	TOTAL									
115	34	MOVE TO PROCESSING FAC	2			300		5	10		
116	34.015	USE MRMS, OTV INTO HGR	1	2		720		12	12	24	
117	34.025	REMOVE AND STORE BRAKE	2			240		4	8		
118	34.03	INSTL OTV IN WORKSTAND	2			180		3	6		
119	34.04	REMOVE BAT/ORD	2			300		5	10		
120	34.055	CONNECT UMBILICALS					1740	29	46	24	
121	34	TOTAL									
122	35	CONDUCT PLANNED MAINTE	2			600		10	20		
123	35.01	REFURBISH AEROBRAKE SYS	2			360		6	12		
124	35.02	REMOVE PUMPS & STORE	2			360		6	12		
125	35.03	REINSTL ENGINES/PUMPS					1320	22	44		
126	35	TOTAL									
127	36	CONDUCT UNPLAN MAINT				0					
128	36.01	CONDUCT UNPLAN MAINT					0	0	0	0	0
129	36	TOTAL									
130	37	INSTALL MODIFICATIONS				0					
131	37.01	INSTALL MODIFICATIONS					0	0	0	0	0
132	37	TOTAL									
133	38	RETEST VERIFICATION	2		6	60		1	2		6
134	38.01	APPLY POWER TO OTV	2		6	60		1	2		6
135	38.02	PERFM OTV HEALTH CKS	2		6	60		1	2		6
136	38.03	POWER DN OTV					180	3	6		18
137	38	TOTAL									
138	39	OTV STO/RET TO FLOW	1	2		60		1	1	2	0
139	39.01	COVER OTV	1	2		60		1	1	2	
140	39.02	SEAL OTV	1	2		60		1	1	2	
141	39.03	REMOVE SEAL	1	2		60		1	1	2	
142	39.04	REMOVE COV & RET TO FLOW					240	4	4	8	0
143	39	TOTAL									
144											
145		TOTAL FLOW TIME									
146		SERIAL TIME (MINUTES)									
147		19140									
148											
149		SERIAL TIME (HOURS)									
150		319									
151											
152		IVA TIME (HOURS)									
153		613									
154											
155		EVA TIME (HOURS)									
156		60									
157											
158		CS-G TIME (HOURS									
159		969									

APPENDIX C

FACILITY ANALYSIS

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DIGITIZED FACILITY CAPABILITIES

DETAILED <VERT PROCESSING FAC > FACILITY RESOURCES

Physical Size:					Crane Capacity:	
Air Lock:	42	74	74	[W/D/H][ft]	10 Ton	69 Ft.Hook Height
Doors:	26	72		[W/H][ft]		
High Bay:	71	143	105	[W/D/H][ft]	25 Ton	95 Ft.Hook Height

Standard Commerical Power: Y

Instrumentation Power [Uninterrupted]: Y

Cleanliness: 100K

E.C.S: Humidity: 45 +/- 5 %

Temperature: 75 +/- 3 F

Closed Circuit Television: Y

Power Cutoff: Y

Facility GN2: Y

Fuel/Oxidizer Disposal: Y

Helium Supply: Y

Shop Air: Y

Fire Protection/Deluge: C

Shower/Eye Wash: Y

Vacuum: Y

Lightning Protection: Y

Potable Water: Y

Paging: Y

Commerical Telephone: Y

RF System: C

OIS: Y

Personnel Airlock: Y

Grounding: Y

Explosion Proof: N

DETAILED <SAEF 2 > FACILITY RESOURCES

Physical Size:					Crane Capacity:	
Air Lock:	41	58	52	[W/D/H][ft]	10 Ton	45 Ft.Hook Height
Doors:	21	39		[W/H][ft]		
High Bay:	49	99	74	[W/D/H][ft]	10 Ton	65 Ft.Hook Height

Standard Commerical Power: Y

Instrumentation Power [Uninterrupted]: N

Cleanliness: 100K

E.C.S: Humidity: 45 +/- 5 %

Temperature: 75 +/- 3 F

Closed Circuit Television: Y

Power Cutoff: Y

Facility GN2: Y

Fuel/Oxidizer Disposal: Y

Helium Supply: N

Shop Air: Y

Fire Protection/Deluge: A

Shower/Eye Wash: Y

Vacuum: Y

Lightning Protection: Y

Potable Water: Y

Paging: Y

Commerical Telephone: Y

RF System: A

OIS: Y

Personnel Airlock: Y

Grounding: Y

Explosion Proof: Y

DETAILED <HANGAR S > FACILITY RESOURCES

Physical Size:					Crane Capacity:	
Air Lock:	14	20	19	[W/D/H][ft]	2 Ton	19 Ft.Hook Height
Doors:	16	20		[W/H][ft]		
High Bay:	45	55	17	[W/D/H][ft]	5 Ton	20 Ft.Hook Height

Standard Commerical Power: Y	Instrumentation Power [Uninterrupted]: Y	
Cleanliness: 100K	E.C.S: Humidity: 50 +/- 5 %	Temperature: 76 +/- 3 F
Closed Circuit Television: N	Power Cutoff: Y	Facility GN2: Y
Fuel/Oxidizer Disposal: N	Helium Supply: Y	Shop Air: Y
Fire Protection/Deluge: A	Shower/Eye Wash: Y	Vacuum: Y
Lightning Protection: Y	Potable Water: Y	Paging: Y
Commerical Telephone: Y	RF System: C	OIS: Y
Personnel Airlock: Y	Grounding: Y	Explosion Proof: N

DETAILED <HANGAR AO > FACILITY RESOURCES

Physical Size:					Crane Capacity:	
Air Lock:	25	29	50	[W/D/H][ft]	10 Ton	47 Ft.Hook Height
Doors:	24	39		[W/H][ft]		
High Bay:	45	175	50	[W/D/H][ft]	10 Ton	48 Ft.Hook Height

Standard Commerical Power: Y	Instrumentation Power [Uninterrupted]: Y	
Cleanliness: 100K	E.C.S: Humidity: 50 +/- 5 %	Temperature: 75 +/- 3 F
Closed Circuit Television: Y	Power Cutoff: Y	Facility GN2: N
Fuel/Oxidizer Disposal: N	Helium Supply: N	Shop Air: Y
Fire Protection/Deluge: A	Shower/Eye Wash: N	Vacuum: Y
Lightning Protection: Y	Potable Water: Y	Paging: Y
Commerical Telephone: Y	RF System: C	OIS: Y
Personnel Airlock: Y	Grounding: Y	Explosion Proof: N

DETAILED <HANGAR AM > FACILITY RESOURCES

Physical Size:					Crane Capacity:	
Air Lock:	0	0	0	[W/D/H][ft]	0 Ton	0 Ft.Hook Height
Doors:	15	34		[W/H][ft]		
High Bay:	63	70	35	[W/D/H][ft]	5 Ton	36 Ft.Hook Height

Standard Commerical Power: Y	Instrumentation Power [Uninterrupted]: Y	
Cleanliness: 100K	E.C.S: Humidity: 45 +/- 5 %	Temperature: 75 +/- 5 F
Closed Circuit Television: Y	Power Cutoff: Y	Facility GN2: N
Fuel/Oxidizer Disposal: N	Helium Supply: N	Shop Air: Y
Fire Protection/Deluge: N	Shower/Eye Wash: N	Vacuum: N
Lightning Protection: Y	Potable Water: Y	Paging: Y
Commerical Telephone: Y	RF System: C	OIS: Y
Personnel Airlock: N	Grounding: Y	Explosion Proof: N

DETAILED <HANGAR AE > FACILITY RESOURCES

Physical Size:					Crane Capacity:	
Air Lock:	25	40	17	[W/D/H][ft]	2 Ton	20 Ft.Hook Height
Doors:	14	36		[W/H][ft]		
High Bay:	43	51	34	[W/D/H][ft]	6 Ton	38 Ft.Hook Height

Standard Commerical Power: Y

Instrumentation Power [Uninterrupted]: Y

Cleanliness: 10K

E.C.S: Humidity: 55 +/- 5 %

Temperature: 72 +/- 3 F

Closed Circuit Television: Y

Power Cutoff: Y

Facility GN2: Y

Fuel/Oxidizer Disposal: N

Helium Supply: N

Shop Air: Y

Fire Protection/Deluge: A

Shower/Eye Wash: N

Vacuum: Y

Lightning Protection: Y

Potable Water: Y

Paging: Y

Commerical Telephone: Y

RF System: C

OIS: Y

Personnel Airlock: Y

Grounding: Y

Explosion Proof: N

DETAILED <CARGO HAZ SERV FACIL> FACILITY RESOURCES

Physical Size:					Crane Capacity:	
Air Lock:	54	80	81	[W/D/H][ft]	15 Ton	75 Ft.Hook Height
Doors:	35	75		[W/H][ft]		
High Bay:	65	152	94	[W/D/H][ft]	50 Ton	85 Ft.Hook Height

Standard Commerical Power: Y	Instrumentation Power [Uninterrupted]: Y	
Cleanliness: 100K	E.C.S: Humidity: 50 +/- 5 %	Temperature: 75 +/- 5 F
Closed Circuit Television: Y	Power Cutoff: Y	Facility GN2: Y
Fuel/Oxidizer Disposal: Y	Helium Supply: Y	Shop Air: Y
Fire Protection/Deluge: C	Shower/Eye Wash: Y	Vacuum: Y
Lightning Protection: Y	Potable Water: Y	Paging: Y
Commerical Telephone: Y	RF System: A	OIS: Y
Personnel Airlock: Y	Grounding: Y	Explosion Proof: N

FACILITY REQUIREMENTS

GROUND BASED OTV

The best fit KSC facility for tasks No. 1 to 13 is the CARGO HAZ SERV FACIL:

The following additions to the CARGO HAZ SERV FACIL are required to exaclty fit those requirements as defined in tasks No. 1 to 13:

	Physical Size:				Crane Capacity:	
Air Lock:	0	0	0	[W/D/H][ft]	0 Ton	0 Ft.Hook Height
Doors:	0	0		[W/H][ft]		
High Bay:	5	0	0	[W/D/H][ft]	0 Ton	0 Ft.Hook Height

Standard Commerical Power: N

Instrumentation Power [Uninterrupted]: N

Cleanliness: 0K

E.C.S: Humidity: 0 +/- 0 %

Temperature: 0 +/- 5 F

Closed Circuit Television: N

Power Cutoff: N

Facility GN2: N

Fuel/Oxidizer Disposal: N

Helium Supply: N

Shop Air: N

Fire Protection/Deluge: N

Shower/Eye Wash: N

Vacuum: N

Lightning Protection: N

Potable Water: N

Paging: N

Commerical Telephone: N

RF System: C

OIS: N

Personnel Airlock: N

Grounding: N

Explosion Proof: Y

Legend:
The NUMBERS indicated in this report are those POSITIVE deltas to be supplied to meet the requirements.

"N"= NO modification is required in the CARGO HAZ SERV FACIL facility:

"Y"= A modification IS required in the CARGO HAZ SERV FACIL facility:

Fire Protection/Deluge= A: fire protection
or B: deluge
or C: both
or N: none

RF System= A: S Band & C Band
or B: Ku Band
or C: both
or N: none

Detailed Composite Facility Resources For Task No. 34 to 39

Physical Size:					Crane Capacity:	
Air Lock:	40	40	50	[W/D/H][ft]	10 Ton	45 Ft.Hook Height
Doors:	35	45		[W/H][ft]		
High Bay:	70	100	85	[W/D/H][ft]	20 Ton	20 Ft.Hook Height

Standard Commerical Power: Y	Instrumentation Power [Uninterrupted]: Y	
Cleanliness: 100K	E.C.S: Humidity: 50 +/- 5 %	Temperature: 70 +/- 5 F
Closed Circuit Television: Y	Power Cutoff: Y	Facility GN2: Y
Fuel/Oxidizer Disposal: Y	Helium Supply: Y	Shop Air: Y
Fire Protection/Deluge: C	Shower/Eye Wash: Y	Vacuum: NA
Lightning Protection: Y	Potable Water: Y	Paging: Y
Commerical Telephone: Y	RF System: A	OIS: Y
Personnel Airlock: Y	Grounding: Y	Explosion Proof: Y

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"BEST FIT"
REPORT

Generating Facility Matches for Ground Based OTV Operations
For Task No: 1 to 13

The following facilites are being evaluated:

No.	Facility	Score
1	CARGO HAZ SERV FACIL	58
2	HANGAR AM	21
3	HANGAR AO	36
4	HANGAR S	26
5	HANGAR AE	28
6	SAEF 2	42
7	VERT PROCESSING FAC	58

Generating Facility Matches for Ground Based OTV Operations
For Task No: 34 to 39

The following facilites are being evaluated:

No.	Facility	Score
1	CARGO HAZ SERV FACIL	58
2	HANGAR AM	20
3	HANGAR AO	34
4	HANGAR S	24
5	HANGAR AE	26
6	SAEF 2	42
7	VERT PROCESSING FAC	56

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FACILITY MODIFICATION REPORT

Detailed Composite Facility Resources For Task No. 1 to 13

Physical Size:					Crane Capacity:	
Air Lock:	40	40	50	[W/D/H][ft]	10 Ton	45 Ft.Hook Height
Doors:	35	45		[W/H][ft]		
High Bay:	70	100	85	[W/D/H][ft]	20 Ton	20 Ft.Hook Height

Standard Commerical Power: Y	Instrumentation Power [Uninterrupted]: Y	
Cleanliness: 100K	E.C.S: Humidity: 50 +/- 5 %	Temperature: 70 +/- 5 F
Closed Circuit Television: Y	Power Cutoff: Y	Facility GN2: Y
Fuel/Oxidizer Disposal: Y	Helium Supply: Y	Shop Air: Y
Fire Protection/Deluge: C	Shower/Eye Wash: Y	Vacuum: Y
Lightning Protection: Y	Potable Water: Y	Paging: Y
Commerical Telephone: Y	RF System: C	OIS: Y
Personnel Airlock: Y	Grounding: Y	Explosion Proof: Y

The best fit KSC facility for tasks No. 34 to 39 is the CARGO HAZ SERV FACIL:

The following additions to the CARGO HAZ SERV FACIL are required to exaclty fit those requirements as defined in tasks No. 34 to 39:

	Physical Size:				Crane Capacity:	
Air Lock:	0	0	0	[W/D/H][ft]	0 Ton	0 Ft.Hook Height
Doors:	0	0		[W/H][ft]		
High Bay:	5	0	0	[W/D/H][ft]	0 Ton	0 Ft.Hook Height

Standard Commerical Power: N

Instrumentation Power [Uninterrupted]: N

Cleanliness: 0K

E.C.S: Humidity: 0 +/- 0 %

Temperature: 0 +/- 5 F

Closed Circuit Television: N

Power Cutoff: N

Facility GN2: N

Fuel/Oxidizer Disposal: N

Helium Supply: N

Shop Air: N

Fire Protection/Deluge: N

Shower/Eye Wash: N

Vacuum: NA

Lightning Protection: N

Potable Water: N

Paging: N

Commerical Telephone: N

RF System: N

OIS: N

Personnel Airlock: N

Grounding: N

Explosion Proof: Y

Legend:
The NUMBERS indicated in this report are those POSITIVE deltas to be supplied to meet the requirements.

"N"= NO modification is required in the CARGO HAZ SERV FACIL facility:

"Y"= A modification IS required in the CARGO HAZ SERV FACIL facility:

Fire Protection/Deluge= A: fire protection
or B: deluge
or C: both
or N: none

RF System= A: S Band & C Band
or B: Ku Band
or C: both
or N: none